Five-Year Review Report

HAGEN FARM SUPERFUND SITE
DANE COUNTY, WISCONSIN

Pursuant to CERCLA

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I. INTRODUCTION

The United States Environmental Protection Agency (U.S. EPA), Region 5, conducted this five-year review pursuant to the Comprehensive Environmental Compensation and Liability Act (CERCLA) section 121 (c), National Contingency Plan (NCP) section 300.400 (f) (4) (ii), and Office of Solid Waste and Emergency Response (OSWER) Directives 9355.7-02 (May 23, 1991), and 9355.7-02A (July 26, 1994). It is a statutory review. The purpose of a five-year review is to ensure that a remedial action remains protective of public health and the environment and is functioning as designed. This document will become a part of the Site file. This is the second five-year review for the Hagen Farm Superfund Site (the Site).

II. SUMMARY OF SITE CONDITIONS & BACKGROUND

The Site is located at 2318 County Highway A, approximately one mile east of the City of Stoughton, Dane County, Wisconsin (Figure 1 - attached). The Site is defined as the area within the Hagen Farm property boundary and the contaminant plume. The property is approximately 28 acres in size. Within the property boundary is a disposal area of approximately 10 acres.

The Site was operated as a sand and gravel pit prior to the late 1950s. Observations suggest gravel operations encompassed an area bounded by the current access road to the east, the former Schroeter property boundary to the west, and the current property boundary to the north (See Figure 2). Mining operations reportedly terminated approximately 14 to 18 feet below ground surface. Excavation may have ceased at this depth due to the presence of groundwater or a change in sand and gravel quality.

The gravel pit was then used for disposal of waste materials from the late 1950s to the mid-1960s. During the period that the Site was operated as a disposal facility, the property was owned by Nora Sundby, since deceased. The property was then purchased from Nora Sundby by Orrin Hagen in November 1977. The Site is currently owned by Waste Management of Wisconsin, Incorporated (WMWI). The Site was operated by City Disposal Corporation. City Disposal Corporation was subsequently purchased by WMWI. City Disposal was also the transporter of much of the waste that was deposited at the Site. It is known that Uniroyal, Incorporated (Uniroyal) generated industrial waste, some of which was deposited at the Site beginning sometime in 1962 and continuing through August 1966.

Waste solvents and other various organic materials, in addition to the municipal wastes, were disposed of at the Site, including acetone, butyl acetate, 1-2-dichloroethylene, tetrahydrofuran (THF), solid vinyl, sludge material containing methyl ethyl ketone and xylenes, and toluene. In a 103(c) Notification submitted to U.S. EPA by Uniroyal, in June 1981, Uniroyal indicated that F003 and F005 wastes (spent non-halogenated solvents), which are hazardous wastes according to the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. 6901, also were disposed of at the Site. This site stopped accepting waste in 1966, prior to regulation of hazardous waste disposal by RCRA Subtitle C.

III. REMEDIAL ACTIONS

Table 1 (attached) presents a chronology of significant site events. The following provides detailed narrative of those events.

A. Investigation & Removal Action

Beginning in November 1980, in response to complaints received from local residents, the Wisconsin Department of Natural Resources (WDNR) began sampling groundwater at nearby private water supply wells. Sampling of the on-Site monitoring wells during the period 1980-1986 indicated certain organic compounds were present in the groundwater, including benzene, ethylbenzene, THF, xylenes, and toluene.

In addition, nearby private water supplies on adjacent properties also contained detectable levels of volatile organic compounds (VOCs). The private wells located on adjacent properties had been impacted by acetone, THF, vinyl chloride, xylene, trans-1,2-dichlorethene, and trichloroethylene.

In 1983, the State of Wisconsin brought an enforcement action for abatement of a public nuisance against WMWI and Uniroyal. At the same time, nearby residents to the Site brought a civil action against WMWI and Uniroyal, seeking civil damages for reduced property values and potential health hazards resulting from groundwater and well contamination. The State of Wisconsin obtained a dismissal of its 1983 enforcement action against WMWI and Uniroyal after the Site was listed on the National Priorities List (NPL). In 1986, the parties to civil litigation brought by the nearby residents to the Site against WMWI and Uniroyal reached a settlement. The exact terms of the settlement are confidential. It is known, however, that one of the terms of the settlement required WMWI to purchase the Site property from Orrin Hagen, as well as other property located adjacent to the Site. Upon acquiring these properties, WMWI razed the structures constructed thereon.

The Site was proposed for inclusion on the NPL on September 18, 1985 and listed on the NPL on July 22, 1987. Two potentially responsible parties (PRPs), Uniroyal, Inc. and WMWI, named by U.S. EPA in connection with the Site, conducted a Remedial Investigation and Feasibility Study (RI/FS) for the Site from 1988 to 1992. This work was conducted under an Administrative Order on Consent (AOC) signed by the PRPs on July 27, 1987. During the RI, two operable units (OUs) were defined for the Site. The OU approach was agreed upon after discussions among U.S. EPA, WDNR, and the PRPs during the early phase of the implementation of the Work Plan for the RI. OU I, which is the Source Control Operable Unit (SCOU), is intended to address waste refuse and subwaste-soils. OU II, which is the Groundwater Control Operable Unit (GCOU), is intended to address the contaminated on- and off-property groundwater at the Site. For purposes of this report, “on-property groundwater” is defined as contaminated groundwater on and in the immediate vicinity of the main waste disposal area and “off-property groundwater” is defined as contaminated groundwater at any location within the plume downgradient of the property boundary.

A.1 Operable Unit I - SCOU

The RI/FS for the SCOU was finalized in July 1990. In general, the RI included the following conclusions: 1) three disposal areas were present, with most of the waste was in one main disposal area which was given the designation “waste disposal area A” or “area A”; 2) hazardous substances were not detected in the two smaller disposal areas; 3) area A is approximately six acres in size, an average of eight feet thick, and contains an estimated 67,650 cubic yards of waste; 4) waste found in area A includes municipal waste, paint sludge, grease, rubber, plastic sheeting, and several industrial chemicals; 5) the major contaminants found in the waste and groundwater around the waste were THF, xylenes, toluene, benzene, ethylbenzene, acetone, 2-butanone, semi-volatiles, barium, lead, and mercury; 6) the waste is in contact with groundwater; 7) wastes are a continuing source for groundwater contamination; 8) contaminants in the waste and groundwater around the waste pose an unacceptable risk to human health, primarily from direct contact, inhalation, and ingestion of on-site groundwater under current- and future-use scenarios.

A.2 Operable Unit II - GCOU

The RI/FS for the GCOU was finalized in April 1992. The RI for the GCOU presented the nature and extent of contamination in the groundwater and evaluated possible exposure pathways. In general, the report included the following conclusions and observations concerning contamination at the Site: 1) the contaminants causing the most concern in groundwater are VOCs. The most prevalent VOC in groundwater was THF with a maximum detected concentration of 630,000 parts per billion (ppb) (the current State cleanup standard is 10 ppb); 2) the occurrence, concentration, and distribution of THF suggested that there is a THF plume originating from the disposal area and extending downgradient (south) approximately 3,600 feet; 3) VOCs were not detected in samples collected from private wells during the investigation; 4) the results of a treatability study indicated that THF and other VOCs in groundwater can be effectively treated using activated biological sludge; and 5) groundwater posed an unacceptable risk to human health, primarily from the potential ingestion of contaminated groundwater near the Site under current- and future-use scenarios.

B. Remedy Selection

B.1 Operable Unit I - SCOU

U.S. EPA, with State concurrence, issued a Record of Decision (ROD) for the SCOU on September 17, 1990. The remedial action objectives of the ROD for the SCOU were to address the contamination source including waste refuse and subwaste-soils. The remedy selected to meet these objectives included:

- Consolidate three waste disposal areas into one area (area A);
- Cap the consolidated wastes;

- Install through the cap and operate an In-Situ Vapor Extraction (ISVE) system;

- Evaluate the promotion of natural microbial degradation activities of VOCs in the waste and subwaste-soils during implementation of the ISVE system; and

- Prevent installation of drinking water-wells within the vicinity of the disposal areas and protect the cap through use of deed and access restrictions.

The consolidation and capping portion of the selected remedial action for the SCOU addressed the source of contamination and reduced the potential human health risks by eliminating the direct contact and inhalation exposure routes. In addition, the capping and ISVE portion of the selected remedial action for the SCOU reduced contaminant loadings to the groundwater, and provided the first step to eliminating potential human health risks associated with the groundwater ingestion scenario.

An Explanation of Significant Difference (ESD) was issued in April 1991. The ESD was initiated after the ROD was signed because information became available to U.S. EPA and WDNR which allowed U.S. EPA to further refine the ISVE cleanup standard. The ROD goal for the ISVE was 90 percent removal of VOCs in the waste/subwaste-soils. U.S. EPA, with State concurrence, made the decision to use a groundwater/soil-gas model (model) for each VOC detected during the RI in the waste/sub-waste soils and/or the groundwater to determine the cleanup standard for the waste/subwaste-soils. In addition, the ISVE was to operate for at least two years prior to running the model. This would insure that data used for the model represented ISVE steady state conditions and reflected ISVE parameters over time. Using the model to determine the cleanup standard ensured cleanup levels that are measurable and reliable, as well as consistent with the NCP.

B.2 Operable Unit II - GCOU

U.S. EPA, with State concurrence, issued a ROD for the GCOU on September 30, 1992. The remedial action objectives of the ROD for the GCOU were to address the contaminated on- and off-property groundwater at the Site. The remedy selected to meet these objectives included:

- Extract and treat of on- and off-property groundwater;

- Treat extracted on-property groundwater using activated biological sludge (ABS) and treatment of extracted off-property groundwater using a technology to be determined by bench scale tests during the design phase;

- Discharge treated groundwater to neighboring wetlands or the Yahara River located 1.5 miles west of the Site;

- Treat and dispose of sludges generated from the groundwater treatment and treatment of off-gasses emitted from the treatment process;

- Use bench scale studies to determine the effect of nutrients and/or oxygen on contaminated groundwater with the goal of enhancing bioremediation in the aquifer;

- Monitor all private wells located around the Site; and

- Use deed and access restrictions to prevent installation of drinking water wells within the vicinity of the disposal area and off-property. Specifically, the selected remedy stated that, "Institutional controls would include on-property land use and on- and off-property groundwater use restrictions in the form of existing deed restrictions to the extent necessary to implement and protect the remedy, and to safeguard human health and the environment during implementation of the remedy. The cooperation of local agencies would be required to limit future off-property use of groundwater if the Respondents [PRP] are unable to obtain deed restrictions from affected property owners. A fence shall be installed around the treatment facility system in order to prevent public access."

Treatment technologies tested on a bench-scale level for the off-property groundwater contamination included cascade aeration, biological treatment, air stripping, granular activated carbon (GAC), and ultraviolet (UV)-chemical oxidation. These tests indicated that biological treatment was the most effective treatment technology for contaminated off-property groundwater at this site.

An ESD was signed on August 27, 1996. The ESD documented and justified three modifications to the selected remedy, as presented in the ROD. The ESD was prepared for the GCOU because information became available to U.S. EPA and WDNR during, and shortly after, the design phase of the project which made modifications to the ROD necessary and/or cost effective. The three modifications included: 1) discharge of treated groundwater back into the ground (reinfiltration), on-site, and near upgradient of the capped waste disposal area instead of to the Yahara River or wetlands; 2) combining extracted on- and off-property groundwater into one influent stream and treating the single influent stream in an on-property treatment facility, as opposed to treating on- and off-property groundwater at two separate facilities; and, 3) use fixed film biological treatment (FFBT) to treat all extracted groundwater instead of ABS.

Concerning modification three; FFBT is essentially the same as ABS, but uses material such as plastic balls to allow the biological component (bacteria) of the treatment process to stick to and be "fixed" in-place. Tests conducted during the design showed that this method provided for better operation and contaminant removal efficiency than ABS.

C. Remedy Implementation

The remedial design/remedial action (RD/RA) for both operable units was conducted by one PRP, WMWI. WMWI settled claims against Uniroyal in December 1992. It is currently the only participating PRP.

In general, the remedial activities were conducted as planned. Significant modifications are documented in two ESDs, discussed in Section B of this report.

A final inspection of the entire site was conducted on April 17, 1996 and included representatives from U.S. EPA, WDNR, and the PRP. At that time, it was determined that the cap, ISVE and groundwater pump and treat system were constructed as designed and were functioning properly.

A Preliminary Closeout Report (PCOR) for the entire site was completed by U.S. EPA on August 27, 1996.

C.1 Operable Unit I - SCOU

RD/RA activities for the SCOU were completed by the PRP under the enforcement authority of an Unilateral Administrative Order (UAO). The UAO for the SCOU was issued to the PRP in March 1991.

The PRP, under U.S. EPA and WDNR oversight, completed the RD for waste consolidation and capping in August 1991. On-Site construction began in September 1991. In general, the remedial activities were conducted as planned. Two smaller areas were exhumed, consolidated into the main disposal area (area A), and area A was capped. Approximately 30,000 cubic yards of refuse were removed from the smaller areas and added to area A. After consolidation, area A contained 97,650 cubic yards of waste requiring a cap. The total acreage of area A did not change. The cap is a solid waste design and includes a clay cap with a geotextile filter. The cap consists of (from bottom to top) 24 inches of clay, 12 inches of drainage gravel, a non-woven geotextile fabric to provide filtration and to keep the gravel clean, 18 inches of rooting zone soil, and 6 inches of vegetative top soil.

Construction of the cap was completed in May 1992. A final inspection of the cap was conducted on July 28, 1992 and included representatives from the U.S. EPA, WDNR, and the PRP. At that time, it was determined that the construction was implemented as designed. A final construction completion report (Final Remedial Action Implementation Report) for the waste consolidation and capping was submitted to U.S. EPA and WDNR in June 1992.

The PRP, under U.S. EPA and WDNR oversight, completed the RD for the ISVE system in August 1993. On-site construction of the ISVE began in September 1993. In general, the remedial activities were conducted as planned. The ISVE system consists of eight vapor extraction wells which are screened from the bottom of the waste through sub-waste soils down to groundwater and twenty-nine gas probes screened at various depths designed to monitor

extraction well effects at various depths and areas throughout and around the landfill. The ISVE discharges VOCs directly to the atmosphere, untreated, in compliance with the substantive requirements of a State air-use permit.

Construction of the ISVE system was completed in January 1994. The system was also in operation at that time and is currently operational. A final inspection of the ISVE was conducted on January 12, 1994 and included representatives from U.S. EPA, WDNR, and the PRP. At that time, it was determined that the ISVE system was constructed as designed. A final construction completion report with as-built drawings was submitted to U.S. EPA and WDNR in February 1994.

A feasibility study presenting an evaluation of promoting natural microbial degradation activities of VOCs in the waste and subwaste-soils was submitted by the PRP to U.S. EPA and WDNR in September 1994. In general, the feasibility study concluded that construction of an enhanced biological treatment system for the SCOU at the Site did not appear either feasible or cost effective for the following reasons: 1) Such a system would provide limited biological enhancement given the relatively small size of the landfill; 2) the existing ISVE system alone is capable of enhancing the needed biological activity without nutrient additions; and 3) such a system would require excavating and removing significant sections of the cap. Construction activities in the cap would have created a high potential for compromising the integrity of the cap. U.S. EPA and WDNR agreed with this conclusion and, therefore, an enhanced natural biological treatment system was not pursued.

The groundwater/soil-gas model providing VOC cleanup standards for the waste/subwaste-soils, as documented in the 1991 ESD, was submitted by the PRP to the U.S. EPA and WDNR in August 1996. The model demonstrated that the system is operating according to design. The predicted waste/soil and corresponding soil gas cleanup levels for THF are 0.1ug/kg and 0.007ug/l, respectively. The predicted waste/soil and corresponding soil gas cleanup levels for total xylenes are 2.6ug/kg and 23.5 ug/l, respectively.

C.2 Operable Unit II - GCOU

RD/RA activities for the GCOU were completed by the PRP under the enforcement authority of an UAO. The UAO for the GCOU was issued to the PRP in November 1992.

The PRP, under U.S. EPA and WDNR oversight, completed the RD for the groundwater pump and treat system in May 1995. On-site construction began in November 1995. The hiatus in time between the design completion and on-site construction was related mainly to contract difficulties between the PRP and its contractor and back-orders for specialized pieces of equipment related to the treatment process such as a site-specific sludge filter press.

In general, the remedial activities were conducted as planned. Significant modifications were documented in an ESD (discussed in Section B.2 of this report and below). The groundwater extraction system consists of four extraction wells within the contaminant plume: Three on-

property near the landfill and one off-property about 800 hundred feet south of the landfill. The system as a whole was designed to pump between 80 and 130 gallons per minute (gpm). The treatment plant was constructed on-property, along the southern edge of the landfill. The treatment system was designed to treat high flow rates (70-100gpm) of moderately to highly contaminated water (ex., >2,000ug/l THF). The treatment plant treated extracted groundwater for VOCs and metals prior to discharge back into the ground, in compliance with the substantive requirements of a Wisconsin Pollutant Discharge Elimination System (WPDES) permit. VOCs were treated using a submerged fixed-film biological treatment. This process destroyed VOCs and, therefore air treatment technologies to capture off-gasses were not necessary. The WPDES discharge permit levels were the State of Wisconsin groundwater Enforcement Standards (ES) presented in Table 2 (attached). Discharge of treated water into the ground occurred through an infiltration gallery. The infiltration gallery is located just upgradient of the landfill.

As documented in the ESD for the GCOU, the treated groundwater was discharged on-site into an infiltration gallery instead of the Yahara River. Bioremediation bench scale studies and computer modeling related to the infiltration gallery indicated that the gallery may help expedite the cleanup by flushing contaminants through the ground into the pumping wells and enhancing bioremediation through the introduction of oxygen rich effluent water into the aquifer. Based on the bench-scale studies, U.S. EPA does not anticipate the need for additional nutrient loadings to the aquifer to enhance bioremediation activities beyond what will be supplied by the infiltration gallery.

Construction of the groundwater pump and treat system was completed in April 1996. A final inspection of the system was conducted on April 17, 1996 and included representatives from the U.S. EPA, WDNR, and the PRP. At that time, it was determined that the groundwater pump and treat system was constructed as designed and functioning properly. The system was anticipated to require an operational period of about 10 to 15 years to achieve groundwater cleanup goals (by the year 2010). However, the system was temporarily shut down on September 4, 2001 to conduct a pilot test using a low-flow air sparge system (discussed below) as a way to achieve final cleanup goals. A final construction completion report with as-built drawings was submitted to U.S. EPA and WDNR in January 1999.

In August 2000, the PRP submitted a proposal for implementation and monitoring of a low-flow air sparge system as a pilot test at the Site to introduce air into the groundwater aquifer and possibly replace the groundwater pump and treat system permanently as a way of attaining cleanup goals for the limited amount of groundwater contamination that is remaining. U.S. EPA agreed with the concepts in the proposal and allowed the PRP to install the low-flow air sparge system in fall 2000, prior to U.S. EPA approval of a complete plan and before system startup and operation. U.S. EPA approved the Low-Flow Air Sparge System Implementation and Monitoring Plan on January 22, 2001 and the system became operational later that month. By reviewing and approving a complete plan concurrent with construction of the system, time was saved and U.S. EPA was able to approve an as-built version of the system along with the concepts and monitoring proposals to support the action. On August 21, 2001, the PRP submitted a proposal

for the temporary shutdown of the groundwater pump and treat system and full scale operation of the air sparge pilot test. U.S. EPA approved the August 21, 2001 PRP proposal on August 23, 2001. The groundwater pump and treat system was temporarily shutdown on September 4, 2001 and the air sparge system is currently in operation.

The addition of air to groundwater at the Site is intended to raise the dissolved oxygen (DO) level in the aquifer and promote natural degradation, not to physically strip compounds from the liquid vapor phase. As a result, much lower flow-rates (5 to 10 cubic feet per minute) are being used at the Site than typical air sparge systems. Six air sparge wells were installed to a depth of approximately 50 feet in a line about 60 feet apart and just downgradient of the landfill (the anaerobic zone). The system initially operated concurrently with the pump and treat system for approximately eight months. Once the air sparge monitoring data indicated that DO levels were increasing, the groundwater pump and treat system was temporarily shut down as a pilot test to determine how effective the air sparge system by itself is at remediating groundwater contamination and, ultimately, in achieving cleanup goals at the Site. As mentioned above, the groundwater pump and treat system was temporarily shutdown on September 4, 2001. The length of time to determine if the air sparge system is working will likely be established within one to two years after temporary shutdown of the groundwater pump and treat system. Based on the results of the pilot test and if U.S. EPA is fully confident that the air sparge system is working according to design, the groundwater pump and treat system may not be needed and the air sparge system may completely replace the groundwater pump and treat system for treating groundwater contamination. This remedy modification may be documented in an ESD at that time. However, the pump and treat system will remain operational until cleanup goals are met in the event that it is needed to control contaminants and/or achieve final groundwater cleanup goals. If the air sparge system works according to the Low-Flow Air Sparge System Implementation and Monitoring Plan, it is estimated that it will take approximately 5-10 years to achieve cleanup goals with the low-flow air sparge system alone.

Groundwater remediation will continue until analyses consistently indicate that the groundwater cleanup objectives have been met. The groundwater cleanup objectives are attainment of the State of Wisconsin's Preventative Action Limits (NR 140 WAC) for contaminants and a cumulative excess lifetime cancer risk not exceeding one in one million ($1x10^{-6}$). Groundwater cleanup objectives are presented in Table 2 (from the September 1992 GCOU ROD).

C.3 Institutional Controls

The SCOU and GCOU RODs required that institutional controls be implemented at the Site to prevent installation of drinking water wells within the vicinity of the disposal area, protect the cap, protect the treatment facility and, to the extent necessary, implement and protect the remedy and safeguard human health and the environment during implementation of the remedy. These controls included securing the Site by placing a security fence around the cap and treatment facility and obtaining deed and access restrictions to prevent installation of drinking water wells. A Site security fence was installed in 1991 as part of the SCOU. The security fence was installed around the entire on-property area and protects the cap, treatment facility and prevents public

access. On-property deed and access restrictions to prevent the use of groundwater were prepared and recorded in 1992 and 1993. As stated in the selected remedy for OUII, off-property institutional controls would be used to the extent necessary to implement and protect the remedy and to safeguard human health and the environment during implementation of the remedy. There were no concerns over implementation and protection of the remedy off-property, therefore, off-property institutional controls were not pursued. In addition, off-property institutional controls were not pursued because there were no proposals or plans to use off-property groundwater during implementation of the remedy and the area defined as off-property was, and still is, either covered by water/wetlands or used for industrial storage purposes that do not require the use of groundwater. In addition, U.S. EPA is not aware of any proposals for future groundwater use in the off-property portion of the Site. More importantly, off-property groundwater contamination is almost nonexistent making future institutional controls unnecessary.

D. System Operations/Operation and Maintenance (O&M) and Progress

Pursuant to CERCLA Section 121(c), a statutory five-year review was completed for the Site on August 14, 1996, five years after RA activities began at the Site (SCOU - August 1991). In general, the August 14, 1996 five-year review concluded that both the SCOU and GCOU remedies were constructed and functioning as designed, and the remedy overall was protective of human health and the environment. The August 14, 1996 five-year review recommended continued operation of the ISVE and groundwater pump and treat system.

The following presents five years of system operations/operation and maintenance (O&M) and progress since the last five-year review (August 14, 1996 to present).

D.1 Operable Unit I - SCOU

A long-term O&M plan for the cap was included in the 100% RD for the cap and approved by U.S. EPA in August 1991. An RA construction completion report, which includes as-built drawings, was submitted by the PRP in June 1992. Long-term monitoring includes yearly inspections of the cap, mowing, and maintaining the fence. Since the cap was installed, yearly inspections have indicated that the integrity of the cap appears to be sound and is functioning as designed. Mowing occurs once a year, and the fence is maintained and in good condition.

A long-term monitoring and O&M plan for the ISVE system was included in the 100% RD for the ISVE dated August 1993 and in the ISVE Remedial Action Implementation Report dated February 1994. The ISVE Remedial Action Implementation Report also includes as-built drawings. ISVE system startup and operation began in January 1994. The system startup activities were conducted in accordance with the approved RD plan. Since that time, the system has operated on a nearly uninterrupted basis, with intermittent short-term shutdowns for system maintenance, adjustments, evaluations of natural microbial degradation of VOCs, and malfunctions. Based on the most current progress report (March 2001) from the PRP, the ISVE flow rates ranged from 95 to 117 cubic feet per minute (cfm).

Monitoring of the ISVE system occurs on a quarterly basis. Monitoring points include the gas probes, gas wells, and the blower station. Monitoring at the gas probes includes measuring gas pressure, photo-ionizing detector (PID) response, and gas composition (oxygen, carbon dioxide, and methane). Monitoring at gas wells includes gas flow, temperature, well pressure, header pressure, PID response, gas composition, colorimetric tube analysis (annually for xylene, toluene, methyl ethyl ketone, and gasoline), and gas sampling and analysis for VOCs at operating wells only. Blower monitoring includes gas flow, temperature, header pressure, air dilution valve setting, PID response, gas composition, colorimetric tube analysis, and gas sampling and analysis for VOCs. Additional monitoring is also performed between quarterly monitoring events, but is frequently done at a reduced monitoring protocol. For example, during the 2000 sample year, eight rounds of sampling occurred (January 21, February 18, March 23, August 8, August 30, October 28, and December 1) at the blower station. The March 25 and August 30 sampling did not include PID response and colorimetric tube analysis.

Two gas probes and one extraction well were opened to the atmosphere in May 1999 to promote air-flow into the subsurface and increase waste degradation. In May 1999, the gas flow rate increased at five other extraction wells, reaching a peak in January and February 2000. After February 2000, the gas flow rate began to decline in four of the five extraction wells, indicating that the effectiveness of leaving the two gas probes and one extraction well open to the atmosphere may no longer be increasing permeability. However, it is possible that closing the extraction well, drawing from it for a period of time, and subsequently opening it to the atmosphere again may once again increase the waste permeability and promote waste degradation. In addition, the oxygen concentrations of four nearby gas probes has risen slightly (approximately 3-5%) since the two gas probes and one extraction well were opened to the atmosphere, indicating that increased aerobic waste degradation may be occurring. However, the increased oxygen concentrations appear to be related to a Site-wide trend as opposed to being directly correlated to opening the gas probes and extraction well to the atmosphere.

D.2 Operable Unit II - GCOU

An O&M plan for the groundwater pump and treat system was submitted by the PRP as part of the May 1995 100%RD. A construction completion report with as-built drawings was submitted by the PRP to U.S. EPA and WDNR in January 1999. A long-term groundwater monitoring plan was submitted by the PRP as part of the July 1993 RD Work Plan. The groundwater monitoring plan was modified in April 2000. The April 2000 modification generally included reducing the frequency of monitoring from quarterly to annual for off-property wells and from quarterly to semi-annual for on-property wells. The groundwater monitoring plan was again modified in January 2001. The January 2001 modification was included as part of the January 2001 Low-Flow Air Sparge System Implementation and Monitoring Plan and generally included increasing the frequency of groundwater monitoring back to quarterly for two years following startup of the low-flow air sparge system. An O&M plan for the low-flow air sparge system was submitted by the PRP as part of the January 2001 Low-Flow Air Sparge System Implementation and Monitoring Plan. This plan also included as-built drawings of the system.

The groundwater pump and treat system startup activities were conducted in accordance with the approved RD Plan. The system was started and became operational in April 1996. Since that time, the system operated on a relatively consistent basis with intermittent shutdowns for system maintenance, adjustment and malfunctions. The system was temporarily shutdown for a air sparge system pilot test on September 4, 2001 (discussed below).

Throughout the system operation, the PRP performed sampling from select influent and effluent points of the system to assess removal efficiency and ensure compliance with the regulatory effluent limits. Based on progress reports from the PRP, the treatment system had continuously treated contaminated groundwater entering the system to levels consistently below discharge standards. Contaminant removal efficiency by the treatment system was generally 99% or more.

Based on groundwater sampling data collected in 2000 and early 2001, THF concentrations did not exceed the cleanup standard in any off-property well and exceeded the cleanup standard in only a few on-property wells located near the landfill. The other cleanup standard exceedances for VOCs were primarily for vinyl chloride. Vinyl chloride was detected at several on- and off-property wells. The highest off-property vinyl chloride concentration was 5ug/l. The highest on-property vinyl chloride concentration was 20ug/l (in a well located in an anaerobic zone of the aquifer immediately downgradient of the landfill).

As documented in PRP-progress reports and groundwater monitoring reports, the majority of the remaining groundwater contamination lies in the anaerobic zone immediately downgradient of the SCOU. A low-flow air sparge system was installed in fall 2000 and began operation in January 2001 to aerate this zone and provide more efficient remediation than that provided by the groundwater pump and treat system. The low-flow air sparge system and the groundwater pump and treat system operated simultaneously for approximately eight months. The groundwater pump and treat system was temporarily shut down on September 4, 2001 as a pilot test to determine how effective the air sparge system by itself is at the remediation of groundwater contamination and, ultimately, in achieving groundwater cleanup goals at the Site. The length of time to determine if the air sparge system is working will likely be established within one to two years after temporary shut down of the groundwater pump and treat system. The groundwater pump and treat system will remain operational until cleanup goals are met in the event that it is needed to control contaminants and/or achieve final groundwater cleanup goals.

IV. FIVE-YEAR REVIEW PROCESS

This five-year review included a document review by the remedial project manager (RPM) assigned to the Site. Documents reviewed included the SCOU and GCOU RODs, ESDs, PCOR, RD Plans, Construction Completion Reports, O&M Plans, progress reports, groundwater and treatment system monitoring results, modification proposals and the 1996 Five-Year Review Report. In addition, a five-year review Site inspection was conducted by the RPM on August 15, 2001. Conclusions from the document review and site inspection are presented below.

V. PROGRESS SINCE LAST FIVE-YEAR REVIEW

A. Operable Unit I - SCOU

The consolidation and capping portion of the selected RA for the SCOU addressed the source of contamination and reduced potential human health risks by eliminating the direct contact and inhalation exposure routes. In addition, the capping portion of the selected RA for the SCOU reduced contaminant loadings to the groundwater, providing the first step to eliminating potential human health risks associated with the groundwater ingestion scenario. The integrity of the cap remains good and the cap is expected to continue to function as designed.

The ISVE system has been continually successful at removing source contaminants from the Site, thereby reducing groundwater contaminants. For all ISVE extraction wells, the majority of VOCs removed were xylenes. In general, the ISVE system and cap successfully work together to reduce contaminant loadings to the groundwater to a greater extent than the cap alone. The combination of these two technologies has resulted in an acceleration toward achieving groundwater cleanup goals as discussed below (Section IV, B.).

As mentioned earlier, the groundwater/soil-gas model providing VOC cleanup standards for the waste/subwaste-soils was submitted by the PRP to U.S. EPA and WDNR in August, 1996. The model demonstrates that the ISVE system is operating according to design. However, the attainment of these predicted cleanup levels at the Site may not be possible since natural attenuation processes, such as soil adsorption and biodegradation that do occur, could not be considered in the model simulations that were used to develop the cleanup levels. This resulted in an extremely low or overly conservative predicted cleanup level. As presented in the model, it is likely that the VOC concentrations in the soil gas will “flat-line” before these cleanup levels are reached. Since the last five-year review (August 1996), U.S. EPA has not interpreted the “flat-line” condition from ISVE data submitted by the PRP. Concentrations of VOCs appear to fluctuate and the ISVE system has continued to successfully remove source contaminants from the Site, thereby reducing groundwater contamination.

The fence remains in good condition and deed restrictions are in place to help aid in eliminating potential human exposure routes and protect the cap and ISVE from vandalism, allowing the SCOU to operate uninterrupted.

B. Operable Unit II - GCOU

During the past five years, the groundwater pump and treat system has operated on a relatively consistent basis with intermittent shutdowns for system maintenance, adjustment and malfunctions. The groundwater plume has been contained and the aquifer has shown dramatic improvements. In addition, the treatment system continuously treated contaminated groundwater entering the system to levels consistently below discharge standards. Deed restrictions to prevent installation of groundwater wells are in place to help eliminate potential human health risks associated with the groundwater injection scenario.

Although effective at containing and remediating the most highly contaminated portion of the plume, the groundwater pump and treat system became increasingly inefficient over the last five years as groundwater contaminant concentrations have significantly declined and the area of the plume decreased dramatically. This reduction in the plume over time is presented in the isomass contour drawings shown in Figures 3 through 6 (attached). These drawings demonstrate the mass reduction of THF at the Site over time. Similar drawings have not been developed from subsequent data due to the significantly lower concentrations of THF in groundwater. Based on groundwater sampling data collected in 2000 and early 2001, THF concentrations did not exceed the cleanup standard in any off-property well and exceeded the cleanup standard in only a few on-property wells located near the landfill. The other cleanup standard exceedances for VOCs were primarily for vinyl chloride. Vinyl chloride was detected at several on- and off-property wells. The highest off-property vinyl chloride concentration was 5ug/l. Table 1 (attached) presents a list of the groundwater cleanup standards (from September 1992 ROD).

The contaminant mass removal rate at the treatment plant was relatively low in comparison to removal through natural biodegredation in the aerobic zones of the aquifer. Based on the average influent concentrations and flow-rates observed from May 1999 through May 2000, an estimated THF mass removal rate of 0.22 pounds per day (lbs/day) was expected during the next year utilizing the current groundwater treatment system. In contrast, the THF mass removal rate in the aerobic zones of the aquifer has been estimated to be as high as 7.2 lbs/day. As contaminant concentrations continue to decrease, the THF mass removal rate at the treatment plant would have decreased even further. Furthermore, the SCOU, made up of a landfill cover and ISVE system, has complimented and accelerated contaminant mass reductions at the GCOU by reducing contaminant loadings to groundwater. Overall, the groundwater pump and treat system provided very limited capabilities to achieve final cleanup goals in the remaining areas of groundwater contamination. Therefore, better remediation of the aquifer needed to be accomplished by the addition of the low-flow air sparge system (detailed in Section D.2).

As documented in PRP progress and groundwater monitoring reports, the majority of the remaining groundwater contamination lies in the anaerobic zone immediately downgradient of the SCOU. The low-flow air sparge system was installed to aerate this zone and provide more efficient remediation than that provided by the groundwater pump and treat system. Low-flow air sparge systems have been shown to dramatically increase DO levels in groundwater and have been demonstrated to enhance naturally occurring degradation of a variety of contaminants. The installation of such a system at the Site is expected to accelerate progress toward remedial goals by producing an aerobic environment downgradient of the landfill. Two primary compounds of concern at the Site, THF and vinyl chloride, degrade most rapidly in aerobic environments. Other considerations taken into account to support the use of an air sparge system at the Site included: A low-flow air sparging system would provide greater reliability with lower maintenance requirements than the existing groundwater pump and treat system and hydraulic containment of the plume is not currently considered critical because down-gradient (especially off-property) groundwater quality has dramatically improved and Site related contaminant impacts on private wells no longer appears to be a concern.

VI. ARARS

The Applicable or Relevant and Appropriate Requirements (ARARs) identified in the SCOU ROD and GCOU ROD for this site remain protective of human health and the environment.

The remedy complies with the performance standards presented in the ROD and ESDs. The groundwater and source control portions are expected to achieve cleanup criteria. These standards and criteria remain protective of human health and the environment.

As previously stated, monitoring events of the designated monitoring wells will continue to be conducted to ensure that groundwater contamination above health-based values has been properly treated to an acceptable risk level.

VII. RECOMMENDATIONS

I recommend the continued operation of the ISVE system at the SCOU until soil cleanup standards are achieved. I also recommend the continued operation of the ISVE system at the SCOU to help reduce contaminant loadings to groundwater by removing contaminants from the source, thereby accelerating the achievement of groundwater cleanup standards for groundwater contaminants of concern at the Site.

I recommend continued active remediation of the groundwater through the low-flow air sparge system, groundwater pump and treat system, or a combination of the of the two until it has been demonstrated to U.S. EPA that groundwater cleanup objectives have been achieved and a petition to cease operation of the system is approved by U.S. EPA.

VIII. STATEMENT ON PROTECTIVENESS

I certify that the remedies selected for this site remain protective of human health and the environment.

The scope of the response actions provide a final remedy to address the risks posed by the contaminants detected on Site.

The RD and RA construction management activities at the Site were conducted by the PRP's construction quality assurance engineer pursuant to the Construction Quality Assurance Plan under the oversight of WDNR and U.S. EPA's Project Managers. The components of the RA were constructed by contractors and sub-contractors to the PRP. All design plans were approved by U.S. EPA. Much of the remedial action field activities were conducted under U.S. EPA oversight.

As previously stated, monitoring events of the designated monitoring wells will continue to be conducted to ensure that groundwater contamination above health-based values has been properly treated to an acceptable risk level.

The approved quality assurance project plan (QAPP) for confirmation analyses was used and will continue to be used during O&M to ensure that all analytical results reported are accurate to the degree necessary for compliance with the SCOU and GCOU RODs.

IX. NEXT FIVE-YEAR REVIEW

Because the remedial action is ongoing (i.e. long-term response action) at this site, another five-year review will be completed by September 30, 2006, which is five years from the date of this review.

Table 1 - Chronology of Significant Site Events at the Hagen Farm Superfund Site

EVENT	*DATE*
Proposed on NPL	September 18, 1985
Listed on NPL	July 22, 1987
AOC Signed by PRP for RI/FS	July 27, 1987
RI/FS (entire site)	July 1988 - April 1992
ROD for SCOU	September 17, 1990
UAO to PRP for SCOU RD/RA work	March 1991
ESD for SCOU	April 1992
RD for SCOU Cap Complete	August 1991
Construction Completion of SCOU Cap	May 1992
Final Inspection of SCOU Cap	July 28, 1992
RD for ISVE Complete	September 1993
Construction Completion of SCOU ISVE	January 1994
Final Inspection of SCOU ISVE	January 12, 1994
RI/FS for GCOU Complete	April 1992
ROD for GCOU	September 30, 1992
UAO to PRP for GCOU RD/RA Work	November 25, 1992
RD for GCOU Complete	May 19, 1995
Construction Completion of GCOU	April 1996
Final Inspection of GCOU & Entire Site	April 17, 1996
Five-Year Review	August 14, 1996
ESD for GCOU	August 27, 1996
PCOR	August 27, 1996
Institutional Controls: Deed Restrictions, Site Fence	1991- 1993
Approval of Low-Flow Air Sparging System Implementation Plan	January 22, 2001
Five-year review Site inspection	August 15, 2001
Next five-year review	September 30, 2006

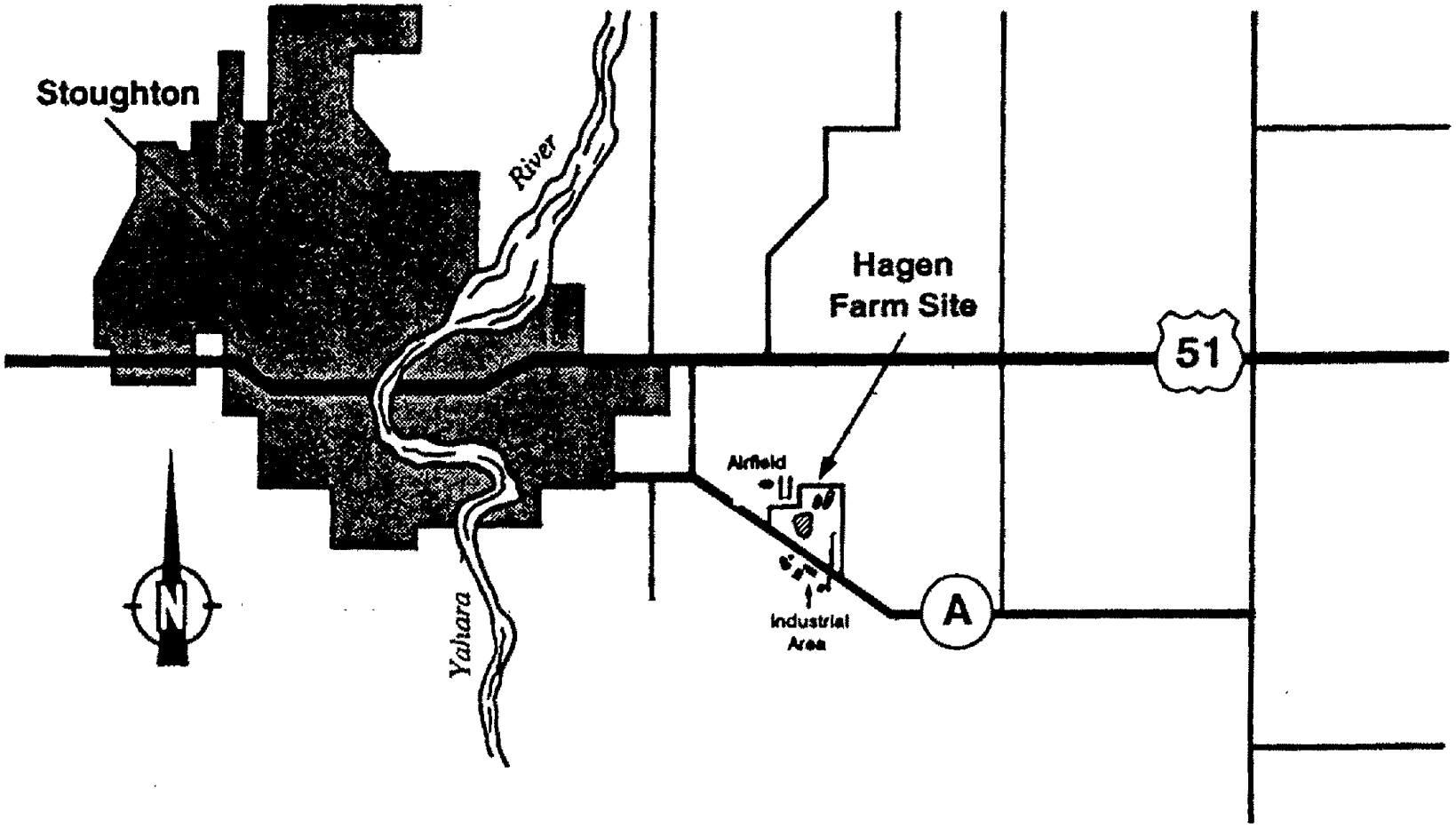
TABLE 2
Hagen Farm Site
Groundwater Contamination
Maximum Levels Detected/Groundwater Cleanup Standards

Compounds	Maximum Concentration (ug/l)		Standards (ug/L)			BD
	On-Property	**Off-Property**	**ES**	**PAL**	**MCL**	
Organic						
Benzene	8	ND	5	**0.067**	5	ND
1,1-Dichloroethene	1	ND	7	**0.024**	7	ND
Ethylbenzene	4,400	ND	1,360	**272**	700	ND
Tetrahydrofuran	630,000	1,200	50	**10**	NA	ND
Toluene	2,700	ND	343	**68.6**	1,000	ND
Xylenes	37,000	ND	620	**124**	10,000	ND
Vinyl Chloride	77	5	0.2	**0.0015**	2	ND
Inorganic						
Arsenic	25.2	ND	50	**5**	50	ND
Barium	1,570	ND	1,000	**200**	2,000	37
Iron	17,000	ND	300	**150**	300[1]	ND
Lead	6	5.6	50	**5**	15[2]	ND
Manganese	3,330	ND	50	**25**	NA	ND
Mercury	6.5	ND	2	**0.2**	2	ND

ES: Enforcement Standard, NR 140, WAC
PAL: Preventive Action Limit, NR 140, WAC
MCL: Maximum Contaminant Level, Safe Drinking Water Act
BD: Background Level
ND: Not-Detected
NA: Not Available

[1] Secondary MCL
[2] Action Level value

Figure 1
Site Location Map
Hagen Farm Site
Dunkirk Township, Wisconsin

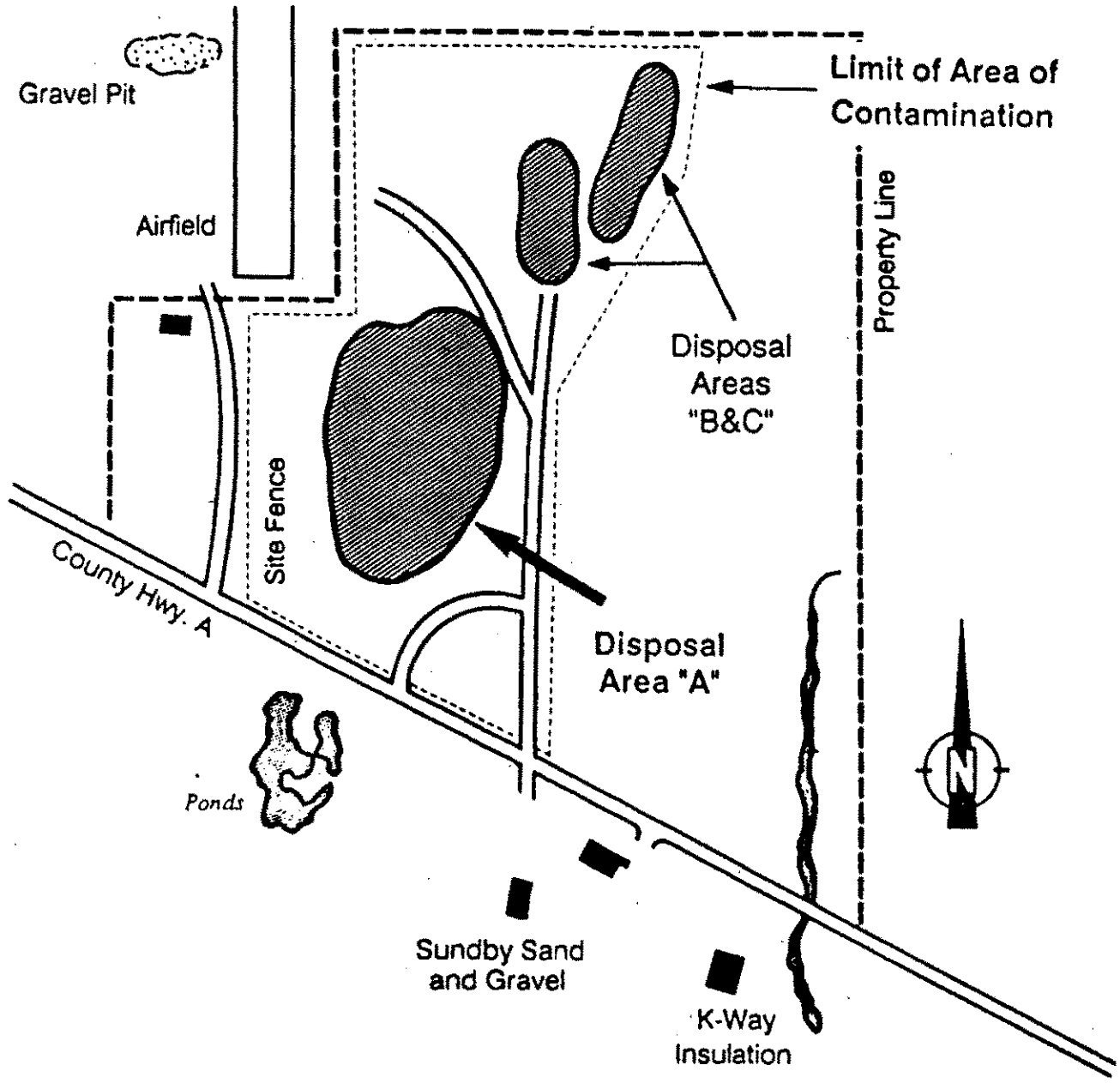


Prepared by Jacobs Engineering Group Inc. Chicago
for the U.S. Environmental Protection Agency, 7/22/90

Drawn AH
Checked DS

Figure 2
Site Diagram
Hagen Farm Site
Dunkirk Township, Wisconsin

(Not To Scale)



JE

Prepared by Jacobs Engineering Group Inc. Chicago
for the U.S. Environmental Protection Agency, 7/22/90

Drawn AH
Checked DS

Figure 3:
THF Isomass Contours - 1990

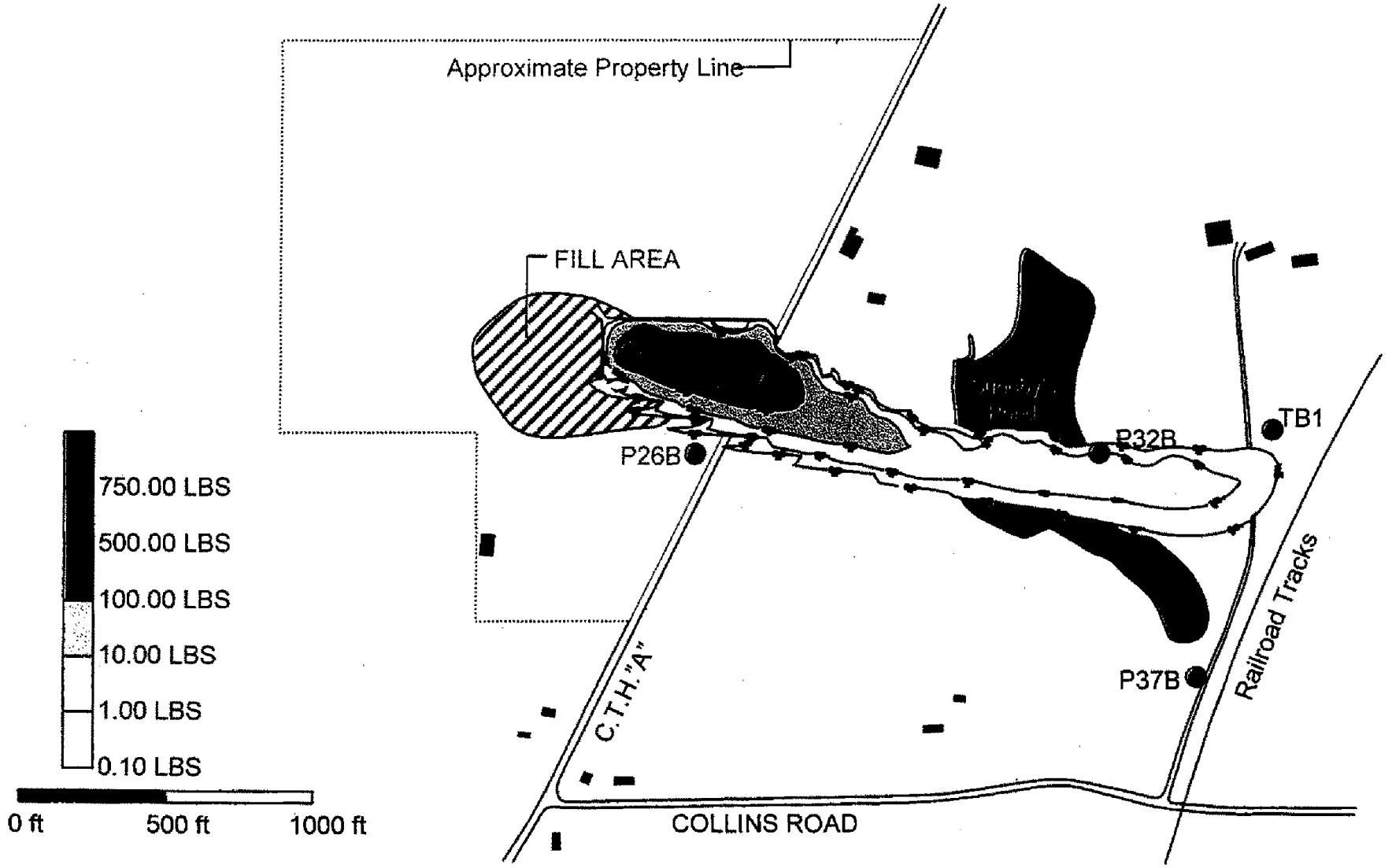


Figure 4:
THF Isomass Contours - 1993

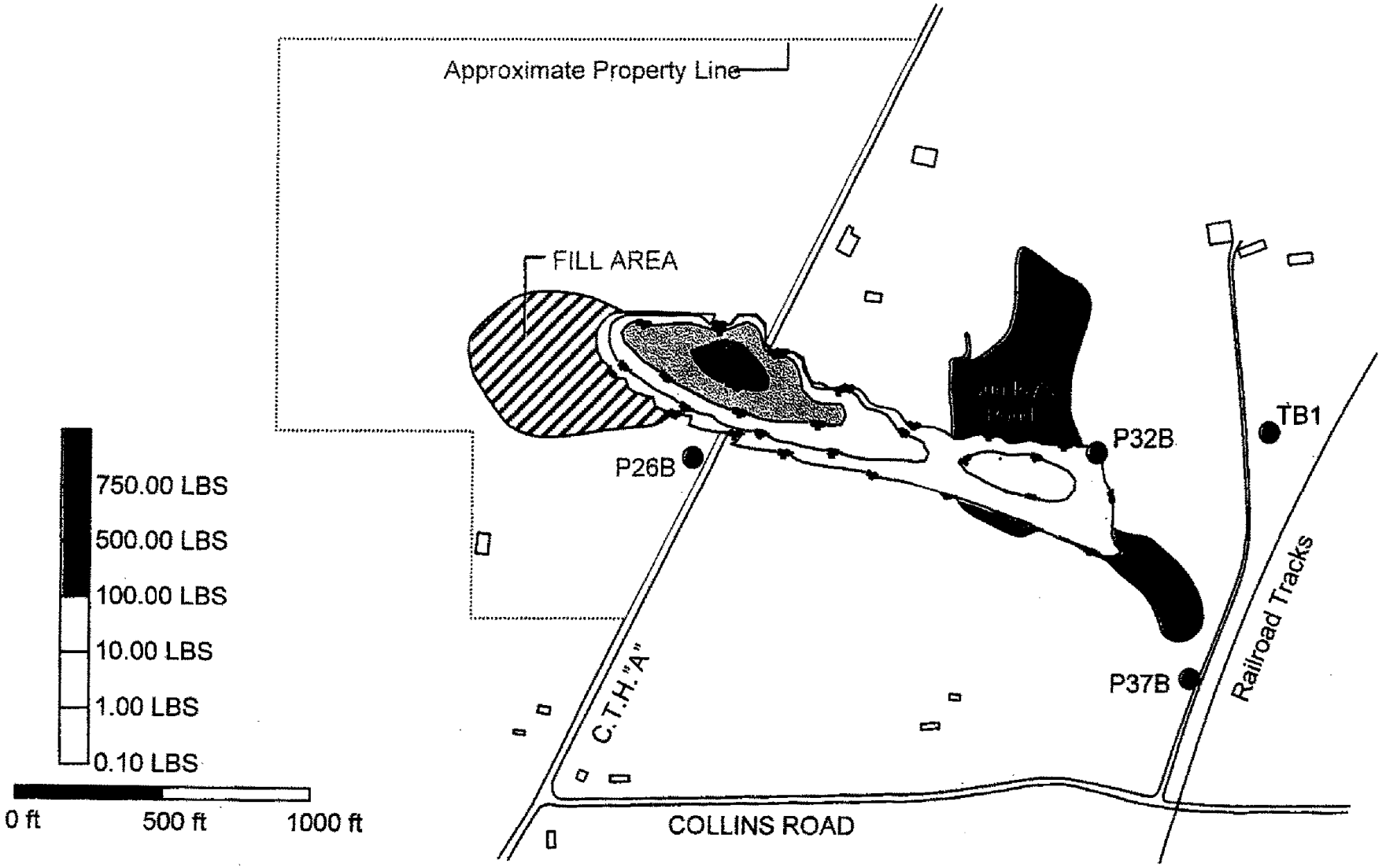


Figure 5:
THF Isomass Contours - 1994

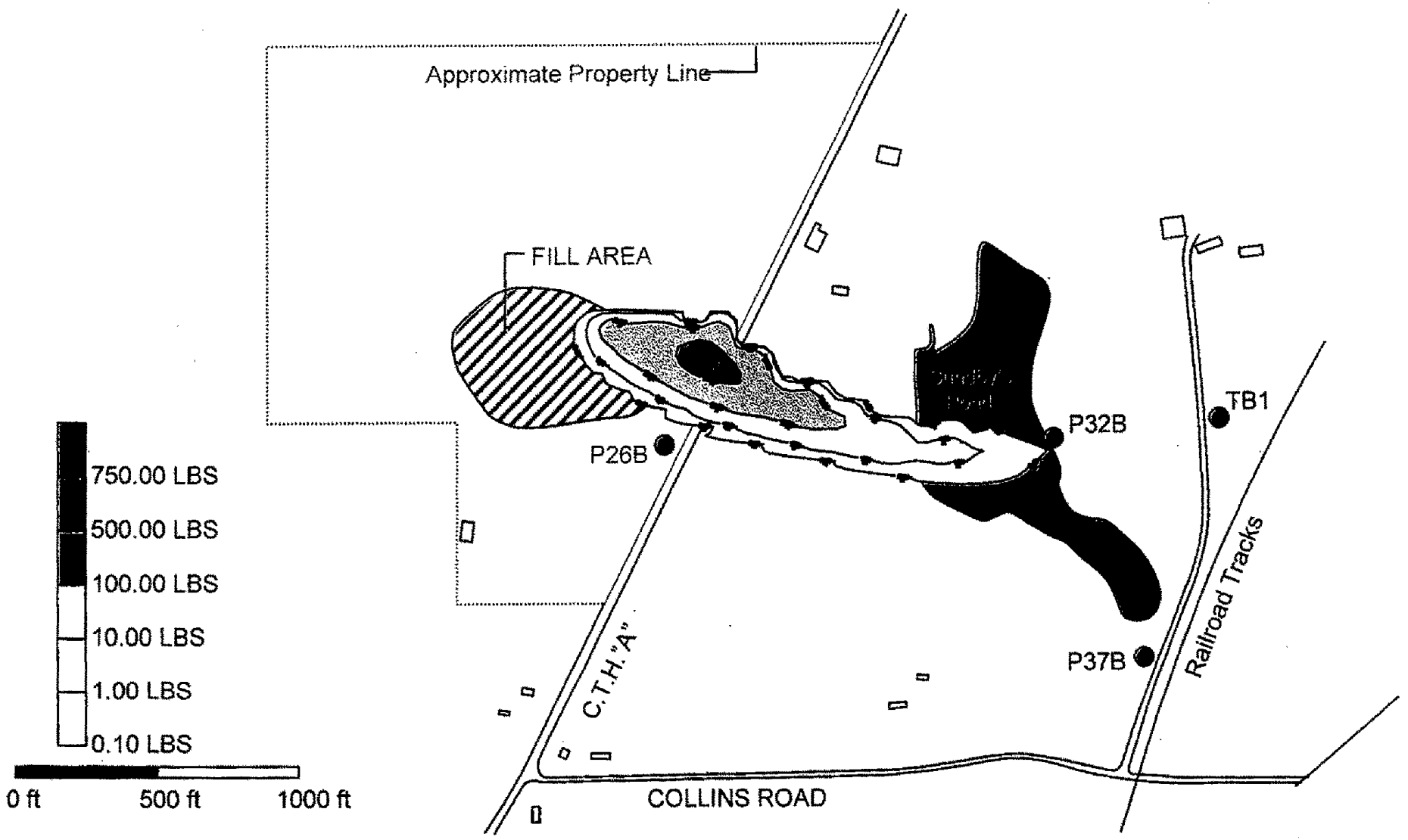


Figure 6:
THF Isomass Contours -1997